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THE PRINCIPLES OF WEATHER FORECASTING.

Forecasting Weather. By Dr. W. N. Shaw, F.R.S. Fully illustrated with maps, charts, and diagrams. Pp. xxviii+380. (London: Constable and Company, Ltd., 1911.) Price 12*s*. 6*d*. net.

THE text-book on "Weather" published by the late Hon. Ralph Abercromby in 1885 generalised the practice in forecasting which had gradually established itself in the Meteorological Office. The recognition in that book of types of pressure distribution associated with distinctive characteristics of wind, temperature, and rain, gave definiteness to the conceptions of cyclones, anticyclones, wedges, and V-depressions, and impressed on the minds of the last generation the dominance of atmospheric pressure over all atmospheric changes. Abercromby wrote with the enthusiasm of lively faith. He believed in cyclones and anticyclones as powers which made the weather—great, simple, and straightforward entities, the ways of which were almost fully known, and only a little additional knowledge required to make the prediction of weather definite and precise.

Recent meteorological researches at home and abroad have gradually involved meteorologists in an atmosphere of doubt as to the simplicity and the certainty of the relations of weather and pressure distribution. During his eleven years' labours as director of the Meteorological Office, Dr. Shaw has done much to initiate and encourage research into the problems most vital to weather forecasting, and the keenest anticipations have been formed as to the nature of the book now before us. In one way we are disappointed; Dr. Shaw has not attacked the Victorian certainties with the vigour of an iconoclast, nor proclaimed a finished system of new beliefs. He recognises the old ideas as idols, but he speaks of them respectfully, not crushingly. He adopts a deprecating tone, indeed, as of one who knows better, and insinuates the well-founded doubts which will enable every candid meteorological mind to recognise its latent idolatry and re-clothe the cyclonic Dagon or remove him quietly out of his place. The book is adapted for a transitional state of mind, ready to abandon the early ways as soon as the larger light is clear enough to make the new path plain, and that is the state of mind of all thoughtful meteorologists; hence it is suggestive rather than didactic, and stimulating rather than systematic. The main value of the work seems to us to lie in the definite formulation of the results of the recent researches carried on under the auspices of the Meteorological Office, and still in progress, researches which bid fair to reorganise the physical basis of weather study, and to make possible a real manual of weather forecasting at some future date. The actuality of the present book is its chief attraction, the reader being brought right to the front of advancing knowledge of weather conditions, and any defects it may possess are defects of that great quality.

Dr. Shaw, as we have hinted already, does not worship the conventional cyclone and anticyclone as the creators and controllers of weather; he shares Prof. Hann's view that these isobaric forms are themselves produced as incidents in the great streams of air which carry on the larger circulation of the atmosphere, and he leads towards the recognition of substantial air-currents of diverse origin flowing in various directions, meeting, and passing in various planes at different angles, as the true causes of weather. He treats moving air in accordance with the well-known principles of physics, and endeavours to establish the dynamical or thermodynamical antecedents of the meteorological phenomena concerned in weather. The work is one of immense difficulty; few men of science would have the courage to attempt it, and we are satisfied that no one having undertaken such a task could have carried it out in a more satisfactory way or with a more effective result than Dr. Shaw has achieved. In the introduction he makes much of the difficulty of the long-abused British units retained by English-speaking meteorologists in both hemispheres, and he outlines a modification of the C.G.S. system which would, he believes, greatly simplify research and exposition. He does not recommend the metric system as used by Continental meteorologists; but a derived system which has the high moral advantage of requiring to be learnt equally by our Continental friends and by ourselves, a sort of arithmetical Esperanto. Temperature is to be expressed in centigrade degrees, but from the absolute zero, so that ice melts at 273° and water boils at 373°. Pressure is to be expressed in fractions of the "C.G.S. atmosphere of 1,000,000 dynes per square centimetre," which corresponds to the normal pressure, not at sea-level, but at an altitude of 106 metres. The decimalisation of measures of time and arc are not suggested, so that the scheme lacks the roundness of theoretical perfection. In practice, so far as this book is concerned, the new system has superseded nothing, for the maps "on which," the author too modestly says, "the book is mainly dependent," are for the most part expressed in Fahrenheit degrees, inches, and Beaufort wind forces. We confess that we do not share Dr. Shaw's enthusiasm for the new system, but it is one of those matters in which the advice of Gamaliel can well be followed, and we do not raise a voice against it.

"Forecasting Weather" is treated in eighteen chapters, of which the first five deal with synoptic charts, the relation of winds to isobars, a statement of Abercromby's view of the order of weather-changes in a cyclone, which still holds good so far as the observed phenomena are concerned, types of weather, and local weather in relation to forecasting. All this is a development of what may be termed the conventional views in which most of us were brought up; but even here the development is very considerable. The question of winds and barometric gradient is happily treated, and the inclination of the wind to the isobars acquires a new significance from the demonstration that a wind moving in a circular path may alter its direction of motion without changing its velocity under the influence of a steepened gradient.

While Abercromby's view of cyclones still explains most of the appearances, Dr. Shaw is careful to point out that the old simple conception of the cyclone as a whirl of air inwards and upwards is not the only one possible, and that similar results would be yielded if the air in any part of the system performed no considerable portion of a complete revolution.

The next three chapters, on the physical processes of weather, the life-history of surface air-currents, and the minor fluctuations of pressure, are the most important in the book, for they are the embodiment of the researches made by the author and his assistants, and they are written with the freshness and conviction only possible when the facts dealt with have been won from the unknown by the narrator himself. Were one inclined to be critical one might perhaps hint that more space than is necessary for an account of weather forecasts is taken up by the curious paradox of cooling by warming, and the quantitatively insignificant condensation by mixing of air of different humidity. Such a criticism, if made, would probably be wrong, for it is precisely such cases which give force to the demonstrations of the great thermodynamical principles still imperfectly grasped by many meteorologists, though held as "fundamentals" from their youth up by the pupils of such men as Kelvin and Tait. Dr. Shaw is at his very best when unravelling the tangled skein of air-trajectories in the path of an advancing cyclone, and it is only when he comes to these chapters that a student unfamiliar with the papers in which the various researches were published can realise to the full how tenderly the author in the new light of his personal researches, which now appear for the first time in a text-book, has dealt with the prepossessions of the holder of the revolving-wheel theory of cyclones.

The old meteorologist must purge his sight of the image of the "revolving storm" if he is to understand what is, after all, the simpler statement of the onward sweep of vast air-streams on the margins or in the heart of which the various "disturbances" occur. Dr. Shaw proves to demonstration that we must view the normal condition of air as one of motion, not of rest, and that the temperate cyclones are disturbances of pressure carried along in the stream, not independent forms moving through normally still air. He shows also, as Hellmann in particular has done in his recent work on the Oder floods, that the isobars of a cyclone are not the simple flowing curves of the weather charts, but when mapped in greater detail for smaller intervals of pressure, and from more stations of observation, they show a variety of "embroidery," as he happily puts it, and in that embroidery resides the explanation of most of the anomalies of the traditional cyclonic convention. We may perhaps be pardoned for hinting that some pertinent examples of the relation of rainfall to isobars might have been obtained if the maps of heavy rains in the pages of "British Rainfall" had been drawn upon; they are at any rate the most detailed instances of the mapping of precipitation. We are also a little sorry that the French terms, *ligne de grain* and *ruban de grain* are not translated and brought into intimate relation with the English *line-squalls,* the fine treatment of which is one of the best points of the discussion of the "embroidery," though were we to sample all the good points we might run some risk of an encounter with the law of copyright.

The remaining chapters, with one exception, deal with practical matters of forecasting as carried out in the London office. Important as they are, these do not carry the same load of scientific interest as the earlier portion, in which we see the rebuilding of meteorological theory as a house is rebuilt by the successive destruction and reconstruction of parts. The exceptional chapter is that on anticyclones, which is all new and of the utmost value. But for its name, which is apparently honoured for the sake of its godfather, the anticyclone would, we fear, be cast down from its high place, and proved to be a very ill-carved fetish. The beneficent purveyor of fine weather, the promoter of brilliant summer warmth and glorious winter cold is, in fact, shown up as an isobaric fraud. The anticyclone is now declared not to be a region of dry, descending air, not to be a focus of winter cold, not to be the country of origin of outward-moving air-currents, not even to be a distinctive meteorological entity. Quoting from his "Life History of Surface Air Currents," Dr. Shaw says:—

> "Further evidence in favour of regarding anticyclones as masses of air which for some reason is not taking part in the circulation going on around it may be derived from the study of anticyclones themselves. They are not of single meteorological character. Local changes of many kinds may take place within them, and almost any kind of weather, except those which represent violent atmospheric changes, may be associated with their central regions."

A chapter on "Forecasts for Aëronauts" gives occasion for a concise account of the present state of our knowledge of the upper air. Brief reference is made to statistical methods for long period and seasonal forecasting, in which various periodical relationships are touched upon, though lightly, and the book concludes with a discussion of the practical utility of weather forecasts, written in an impartial and eminently scientific spirit. In this respect a strong point is made of the necessity of trained intelligence and some knowledge of meteorology on the part of the public in order to fit them to understand and test the forecasts as issued in the Press. Until some such educational groundwork is laid, Dr. Shaw thinks that we cannot be said to have a *system* of forecasting, for the work of the office is only half the story. As to the possibility of future improvements, he says:—

> "It is quite possible that the progress of research, guided primarily by the wish to improve the daily forecast, will lead to the recognition of, or find material for, the development of laws of a more general character that will enable us to anticipate the weather for the season or the month. It is only by close practical study that such an object can be achieved."

The example set by the director will, we are sure, be followed by the band of trained disciples he has gathered round him at the Meteorological Office, and even although the infallible forecaster may never arise, the advance of knowledge by the method of research cannot fail to repay many times over the wisely administered expenditure of the public money entrusted to the Meteorological Committee.

HUGH ROBERT MILL.

THE HISTORY OF MEDICINE.

History of Medicine. By Prof. M. Neuburger. Vol. i. Translated by E. Playfair. Pp. x+404. (London: H. Frowde and Hodder and Stoughton, 1910.) Price 25*s*. net.

THE first volume of this history of medicine by the professor of the subject in the University of Vienna deals with the period *ab initio mundi* to the end of the Middle Ages. A somewhat confused preface by Sir William Osler introduces the work, asserting on the first page that professorships on the subject have been established in English universities, and on the second page that "there is not in this country a single chair of the history of medicine." The Fitzpatrick lectureship on the history of medicine in the Royal College of Physicians of London is mentioned, but Sir William Osler fails to perceive that it was established with the obvious intention that the lecturer should always be a physician learned in medicine, as well as in the part of its history which he might select for his lectures. The courses which have been delivered during the past nine years by three members of the University of Oxford and two of the University of Cambridge have shown the usefulness of such a provision. They have been worthy examples of the same school as "The History of Physick from the time of Galen to the beginning of the Sixteenth Century," written by Dr. John Freind in 1723, a book which is at once pleasant reading, sound medicine, and good history.

The history of medicine as written by men ignorant of its practice and inexperienced in the observation of disease is rarely of the first order. Littré, whose writings are a valuable contribution to medical history, is no example to the contrary, for he had completed his medical education and had meditated deeply on all he had seen in the wards, though, in consequence of his poverty, he did not actually take a medical degree. It is the fact that the late Dr. J. F. Payne was a physician of wide attainments in his profession, as well as a scholar deeply read in medical books, which makes his writings such valuable contributions to the history of medicine. Van Swieten was the chief physician of Vienna, and his commentaries on the aphorisms of Boerhaave contain a better history of the growth of the knowledge of disease up to about 1760 than can easily be found anywhere else. If a medical faculty has not in it a physician willing to add to the history of medicine, his place can never be supplied by what this preface calls "archivists" and "backstairs men."

Prof. Neuburger's first volume begins with primitive medicine as illustrated by the trephine holes in Neolithic skulls and by the proceedings of modern savages. He then gives some account of medicine among the Sumerians, Babylonians, and Assyrians, sufficient to show that scarcely anything is known of it. The next chapter, on the medicine of the ancient Egyptians, contains some interesting fragments of information, but would have been more valuable had its statements been illustrated by descriptions of the actual specimens to be seen at Cairo and in other Egyptian collections. The writings of Eliot Smith are far more illuminating on the subject of the Egyptian knowledge of anatomy, pathology, and surgery. A chapter on the ancient Persians contains scarcely enough information to rouse curiosity.

The well-known passage in Ecclesiasticus on the physician is quoted, and cannot be quoted too often, but the medicine of the Old Testament is very imperfectly discussed. Robertson Smith's acute remarks on the golden emerods and mice in relation to an early epidemic of plague, for example, are not mentioned. The medicine of Hindustan and that of the Chinese and Japanese are treated in two longer chapters, and the reader anxious for first-hand information then passes on with relief to medicine in classic antiquity, to the Homeric healing art, to the Greek physicians, theories, and medical schools, and to two interesting chapters on Hippocrates. Prof. Neuburger venerates the Father of Medicine, and says that he is

> "Admired by all, really understood by few, imitated by many, equalled by none; he was the master of medicine for all time."

When it is remembered that the Hippocratic school practised, as indeed is well described in this book, palpation and auscultation, it is scarcely correct to say that "Prognosis gives to the mental attitude of the Hippocratist its characteristic colouring, and leaves diagnosis far behind it in importance," though, of course, it is true that the Hippocratic view of prognosis required the practice of an almost hourly meditation on the course of the disease *pari passu* with observation of the symptoms. The transplantation of Greek medicine to Rome, Asclepiades the friend of Cicero, as well as several later physicians and schools, are discussed. Galen is dealt with in a long chapter, and the general character of his writings is justly presented to the reader. It is certainly true that by him "special pathology is well represented, and in the chaff of irresponsible speculation there is hidden many a grain of genuine observation and surprisingly clear insight." Medicine in the decline of antiquity is then described, with a somewhat disappointing chapter on Byzantine medicine and one on Arabic medicine, which adds little if anything to the account of the Arabian physicians published by Ferdinand Wüstenfeld in 1840. The second volume is to deal with the medicine of the Renaissance and of modern times.

The defect of the book is a desire to mention too many facts, with the result that few parts of the history are set forth at sufficient length to be clear or to be interesting. Prof. Neuburger's style is often rhetorical, but he generally fails to excite in his reader a living interest in the men of whom he tells or in the books which he describes, and there is the more